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(54) **Polyethylene composite film and label.**

(57) Disclosed are a polyethylene composite film used for displaying materials, balloons and various packaging materials, which is excellent in moistureproofness, clarity, bending properties and pinhole resistance, comprising an oriented polyethylene film in which the degree of crosslinking inwardly decreases across the thickness of the oriented polyethylene film on which printing is performed and a film laminated on the printed surface; and a label suitably used for a polyethylene bottle comprising the above oriented polyethylene film on which printing is performed and an adhesive layer formed on the printed surface.

range of about 10 to 50 microns.

Printing can be performed on the BOPE film by, for example, gravure, offset printing, silk screen printing and flexographic printing.

Examples of the films to be each laminated on the BOPE film on which back surface printing is performed include plastic films, particularly unoriented, uniaxially oriented or biaxially oriented films of polyolefines such as polyethylene and polypropylene, polyesters and polyamides. Of these, the above-mentioned BOPE film, particularly the metal-deposited BOPE film, is preferable, in respect to the further improvement of the luster and the color tone of the printed surface.

Metal deposition on the BOPE film can be performed by vacuum deposition in which the film is placed in a vacuum equipment highly evacuated (10^{-4} to 10^{-8} mm Hg) and a metal is heated for evaporation in the equipment, whereby the metal radially scattered is deposited on the surface of the film. There are also available ion plating and sputtering deposition utilizing a phenomenon that a metal constituting a cathode is scattered when discharges are induced under vacuum. Examples of the metals for deposition include Al, Zn, Au, Ag, Cu, Ni, Cr, Ge, Se, Ti and Sn. It is preferable to use Al, because the reflection of the back surface of the film on which back surface printing is performed can be increased to improve the luster and the color tone thereof and Al is excellent in operability and economy.

The thickness of a metal-deposited layer is preferably 200 to 800 angstroms.

If the film is preliminarily treated with corona discharge, the adhesion of the film to the metal can be improved.

The basic structure of the composite film consists in a laminate comprising the BOPE film on which printing is performed and the above-mentioned plastic film or metal-deposited film (including a film other than the BOPE film), the printed surface of the BOPE film being laminated on the plastic film or the deposited surface of the metal-deposited film. However, another BOPE film may be further added as an intermediate layer between the printed surface and the metal-deposited surface.

Moreover, a sealant layer may be provided on the outer layer of the above-mentioned laminated plastic film (including the deposited film).

For the sealant layers, there are used low density polyethylene (LDPE), linear low density polyethylene (LLDPE), ethylene-vinyl acetate copolymer (EVA), ethylene-ethyl acrylate copolymer (EEA), ionomer and the like. The composite film is produced by laminating the material layers on each other by any of (1) dry laminate method, (2) wet laminate method, (3) extrusion coating laminate method and (4) hot melt laminate method.

As adhesives used for lamination, there may be used various adhesives such as urethane-series adhesives, vinyl acetate-series adhesives, acrylic adhesives and rubber-series adhesives.

The thickness of the composite film is suitably selected depending on the object and the use, but generally in the range of about 20 to 200 microns.

A label embodying the present invention will hereinafter be described, based on the drawings.

A label 2 of the present invention is stuck on a plastic (polyethylene) bottle 1 as shown in Fig. 1A and used for the purpose of indicating its contents.

Fig. 1B is a sectional view showing an example of the label 2.

In Fig. 1B, the reference numerals 3, 4 and 5 designate a BOPE film in which the degree of crosslinking inwardly decreases across the thickness of the film, a printed surface formed by performing printing on one side (back surface) of the BOPE film, and an adhesive layer, respectively. As the BOPE film 3 described above, there may be used a film similar to the BOPE film employed in the composite film. The thickness of the BOPE film 3 is similar to that of the BOPE film employed in the composite film and printing is also performed similarly thereto. As an adhesive constituting the adhesive layer 5 on the printed surface 4 of the BOPE film 3, there may be used an adhesive similar to one exemplified in the above-mentioned composite film. In this case, it is particularly preferable to use an adhesive which is possible to be heat bonded to a bottle in a mold when the bottle is formed by blow molding.

Examples of methods for applying the adhesive layer 5 on the printed surface 4 of the BOPE film 3 include a method of applying the adhesive on the printed surface 4 of the film 3 with a roll or the like and a method of coating the printed surface 4 with the adhesive by extrusion. The adhesive layer 5 is usually formed to a thickness of about 5 to 20 microns.

The thickness of the label 2 is suitably selectable depending on the use, but generally in the range of about 50 to 130 microns.

The label 2 can be stuck on the surface of the bottle in the mold at the same time that the bottle is formed by blow molding.

An example of the blow molding will hereinafter be illustrated according to Fig. 1C.

In the blow molding, a polyethylene parison which is cylindrical in a softened state is formed by extruding polyethylene from a parison die 7 through an extruder 6, and then mold parts 8 and 9 are closed. Air is blown into the parison from a blow pin (air blowing member) 10 to expand the parison along an inner configuration of the mold parts 8 and 9. After cooling, the mold parts 8 and 9 are opened and the bottle 1 is taken out. When the air is blown into the parison to expand it, the label 2 is previously set in either of the mold parts 8 and 9. In this drawing, there is shown an example in which another label 2 is set in the mold part 9, after the bottle 1 on which the label 2 has been stuck is taken out, and thus these procedures are circulated.

The composite film of the present invention is excellent in luster and color tone of the printed surface. The BOPE film as a substrate is excellent in moistureproofness and clarity. The composite film is therefore

also excellent in such properties, and in addition is good in bending properties and in pinhole resistance.

Due to the properties described above, the composite film of the present invention can be applied to various uses, particularly to various packaging materials such as high-class wrapping paper imaging wrapping cloths, displaying materials such as calendars and posters and balloons.

The label of the present invention has back surface printing, and the BOPE film is good in clarity. Hence, the printed surface provide a three-dimensional, clear, integral feeling as if curved-surface printing has been performed on the bottle itself. The label is further resistant to water wetting and contamination.

The label is sufficient in rigidity and strength, and therefore is possible to be thinly formed. Accordingly, the label is economical. In particular, the label is unnecessary to be stripped on recovery when the label is stuck on a polyethylene bottle occupying the main of blow-molded bottles, because the material of the label is identical with that of the bottle. Further, the label of the present invention does not grow moldy, and therefore shows cleanliness for sanitary uses.

Due to the properties described above, the label of the present invention can be employed as labels for various uses, particularly is suitable for a label for in-molding.

The present invention will be described in accordance with the following Examples and Comparative Examples.

Example 1

A stock sheet (gel fraction: crosslinked outer layer/uncrosslinked inner layer/crosslinked outer layer = 50/0/50, ratio of each layer in thickness: crosslinked outer layer/uncrosslinked inner layer/crosslinked outer layer = 1 : 1.75 : 1, thickness: 500 microns) formed of high density polyethylene (density: 0.957 g/cm^3, MI: 1.0 g/10 minutes) and crosslinked by irradiation of electron beams was stretched 4 X 6 times at 127°C to form a biaxially oriented film (hereinafter referred to as BOHD film). The film thus obtained had a haze value of 2.7 % and a water vapor transmission rate of 3.6 g/m^2/24 hours.

Then, this BOHD film was treated with corona discharge, followed by four-color gravure on the treated surface.

On the other hand, the BOHD film described above was treated with corona discharge, and then aluminium was deposited under vacuum over this treated surface so as to have a thickness of 500 angstroms, thereby forming an aluminium-deposited film.

Then, the above-mentioned printed surface on which gravure was performed of the BOHD film was bonded for lamination to the above-mentioned deposited surface of the aluminium-deposited film (Al-deposited BOHD film) by a dry lamination method using an urethane-series adhesive to form a composite film.

The measurements of luster, visual evaluation and the evaluation of bending property were carried out from the side of the printed surface of the composite film thus obtained. The results are shown in Table 1. This composite film was further used for packaging a box-shaped article. As a result, this composite film was also excellent in bending property (dead fold property). Furthermore, the composite film was very small in the number of pinholes after flexocracking and hence was excellent in pinhole resistance.

Examples 2 to 7

Composite films were obtained in the same manner as with Example 1 except that an Al-deposited PET film (12 microns), a PET film (12 microns), an OPP film (20 microns) and a LLDPE sealant film were used as the films for lamination on the printed surface of the BOHD film. The results of the measurements of luster, visual evaluations and the evaluations of bending property of the respective composite films are also shown in Table 1.

Comparative Examples 1 and 2

In Example 1, a PET film and an OPP film were used in place of the BOHD film and four-color gravure was performed on one side of each film. On the printed surfaces were similarly laminated a PET film (12 microns) and an OPP film (20 microns), respectively, thereby forming composite films. The results of the measurements of luster, visual evaluations and the evaluations of bending property of the respective composite films are also shown in Table 1.

Test methods employed herein are as follows:

(1) Visual Evaluation

Three observers judged the color tone of the printed surfaces. A very excellent sample in which the deep color tone was felt was indicated by◎, an excellent sample by○, an ordinary sample byΔ, and a somewhat poor sample by X.

(2) Bending Property (Dead Fold Property)

When a composite film sample was folded double, a sample having a restoring angle of less than 90 degrees was indicated by○, a sample having a restoring angle of 90 to 180 degrees byΔ, and a sample not creased by X.

Table 1

Example No.	Layer Structure of Film (BOHD-Printed Surface/Lamination Film)	Lamination Method	Visual Evaluation	Bending Property
1	BOHD/Al-deposited BOHD	Dry lamination	◎	○
2	BOHD/Al-deposited PET	Dry lamination	○	Δ
3	BOHD/PET	Dry lamination	○	Δ
4	BOHD/OPP	Dry lamination	○	Δ
5	BOHD/BOHD*/Al deposited BOHD	Dry lamination/dry lamination	◎	○
6	BOHD/Al-deposited BOHD/LLDPE*	Dry lamination/dry lamination	◎	○
7	BOHD/BOHD*	Dry lamination	◎	○
Comparative Example No.				
1	PET printed surface/PET	Dry lamination	Δ	×
2	OPP printed surface/OPP	Dry lamination	×	×

BOHD*: No printed surface
LLDPE*: Sealant layer

Example 8

The BOHD film obtained in Example 1 was treated with corona discharge, and then four-color gravure was performed on this treated surface.

The printed surface of the BOHD film was coated with 5 g/m^2 of an ethylene-vinyl acetate (EVA) emulsion. After drying, the resulting film was cut to an elliptical form with a major axis 100 mm long and a minor axis 60 mm long to form a label. The label thus obtained was set in a mold for blow molding. High density polyethylene was formed into a 200 ml bottle by blow molding, and as the same time the label was stuck on the surface of the bottle as a label for in-molding.

The label thus obtained had a clear back surface print and an integral feeling as if curved-surface printing had been performed on the bottle itself. Water or stains could be easily swabbed from the label, and the contamination and the breakage of the label were avoided.

Claims

1. A polyethylene composite film comprising an oriented polyethylene film in which the degree of crosslinking inwardly decreases across the thickness of the oriented polyethylene film, printing being performed on one side of said oriented polyethylene film, and a film laminated on the printed side.

2. The polyethylene composite film as claimed in claim 1, in which said oriented polyethylene film has a structure of a crosslinked layer/uncrosslinked layer/crosslinked layer across the thickness of the film.

3. The polyethylene composite film as claimed in claim 1, in which said film laminated on the printed side comprises an oriented polyethylene film and an aluminium-deposited layer formed thereon, and the printed side of the oriented polyethylene film is bonded to the deposited surface of the film having the aluminium-deposited layer.

4. The polyethylene composite film as claimed in claim 1, in which said composite film has a sealant layer on an outer surface of the film laminated on the printed side.

5. A label comprising an oriented polyethylene film in which the degree of crosslinking inwardly decreases across the thickness of the oriented polyethylene film, printing being performed on one side thereof, and an adhesive layer formed on the printed side.

FIG. 1A

FIG. 1B

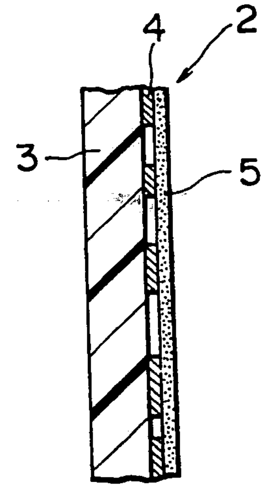
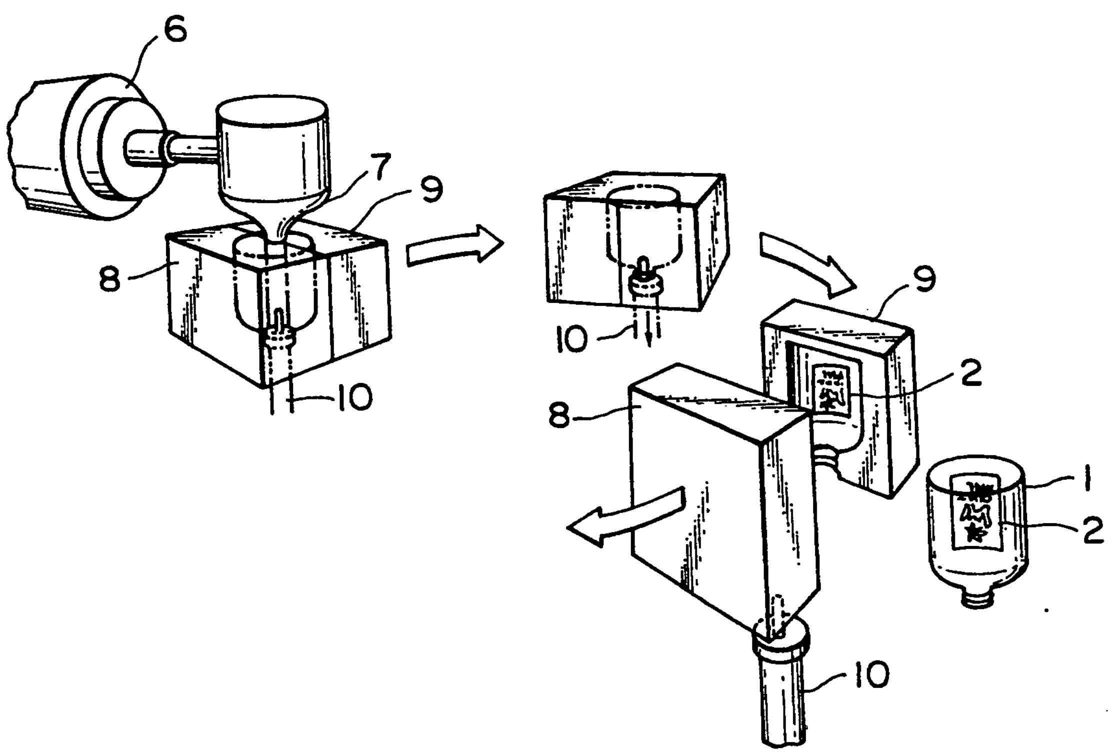


FIG. 1C



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EP 0 358 445 A3

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EUROPEAN SEARCH REPORT

Application Number

EP 89 30 8965

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
P,Y	EP-A-0 317 237 (TOA NENRYO KOGYO K.K.) * Page 2, line 47 - page 3, line 1; page 3, lines 39,40; claims 1-5 *	1-4	B 32 B 27/32 G 09 F 3/02 B 32 B 5/14
Y	EP-A-0 011 274 (COORS CONTAINER CO.) * Claims 4,5,7 *	1-4	
D,A	EP-A-0 120 672 (TOA NENRYO KOGYO K.K.) * Claims 1,2 *	1,2	
A	EP-A-0 022 184 (BAYER AG) * Claim 1 *	1	
A	FR-A-2 222 226 (A.B. ZIRISTOR) * Figure 2; page 1, line 36 - page 2, line 15 *	5	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 32 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	07-09-1990	MCCONNELL C.H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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